DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

49 CFR Parts 172 and 173

[redacted]

Packaging and Placarding Requirements for Liquids Toxic by Inhalation

AGENCY: Materials Transportation Bureau, Research and Special Programs Administration, DOT.

ACTION: [redacted]

SUMMARY: This notice proposes special packaging and more stringent placarding requirements for certain poisonous liquids based on their potential inhalation hazards. This action is necessary because the Materials Transportation Bureau (MTB) believes there are deficiencies in the packagings

presently specified for such materials when they become authorized by reference to "n.o.s." (not otherwise specified) packaging sections. Also, MTB believes such materials should be subject to the placarding requirements specified in the Hazardous Materials Regulations (HMR) without exception. The intended effect of this action is to establish a higher level of safety for the transportation of toxic liquids that pose serious inhalation risks.

DATE: Comments must be received on or before March 14, 1985.

ADDRESS: *Address comments to:* Dockets Branch, Materials Transportation Bureau, U.S. Department of Transportation, Washington, D.C. 20590 and be submitted, if possible, in five copies. The Dockets Branch is located in room 8426 of the Nassif Building, 400 Seventh Street, SW., Washington, D.C. Office hours are 8:30 a.m. to 5:00 p.m., Monday through Friday.

FOR FURTHER INFORMATION CONTACT: [redacted] Office of Hazardous Materials Regulation, Materials Transportation Bureau, Department of Transportation, 400 Seventh Street, SW., Washington, D.C. 20590 (202–426–2075).

SUPPLEMENTARY INFORMATION:

Need for Action

On December 3, 1984, a discharge of a material identified as methyl isocyanate (MIC) occurred at the pesticide plant of Union Carbide (India) in Bhopal, India. More than two thousand people died as a result of the discharge.

On December 19, 1984, the Chairman of the National Transportation Safety Board (NTSB) addressed a letter to the Administrator of the Research and Special Programs Administration (RSPA), urging the Department to re-examine its system of hazard identification and classification, and to update it in accordance with current technology in order to raise the minimum level of protection provided in the Hazardous Materials Regulations. The NTSB letter is as follows:

> Dear Ms. Douglass: The December 3, 1984, release of methyl isocyanate (MIC) from a manufacturing plant at Bhopal, India, resulted in a tragedy of monumental proportions. It is difficult to accept the fact that a material, whose primary hazard as classified by the Department of Transportation (DOT) is its flammability, would cause such widespread death due to its toxicity.
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> Because of its continuing concern about deficiencies in the DOT's hazard identification and classification system, as described in the Safety Board's Safety Report, "Status of Department of Transportation's Hazardous Materials Regulatory Program," (NTSB–SR–81–2) and more recently, as discussed at its July 26–27, 1983, public hearing on the safety of railyards in populated areas, the Board has compiled toxicity and other data for these materials and information about the safety measures taken by Union Carbide and others in their transportation. Our review of this information indicates that there is an urgent need to improve the manner in which toxic materials are classified and to raise the minimum levels of protection required by federal regulations in transporting these materials.
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> Although MIC is classified by DOT regulations as flammable liquid just as is gasoline,[1] Union Carbide's handling of this material reflects more fully the true hazard it presents. For example, without limits on the quantity per container and in accordance with DOT regulations, Union Carbide or anyone else, could elect to ship this material by rail in the least protected of DOT specification tank cars (ARA, 103, 104, and 111); instead, Union Carbide requires MIC to be transported in DOT Specification 115 tank cars which are double-walled and insulated and have stainless steel tanks limited in capacity to 8,000 gallons. Similarly, containers offering greater than the required protection are used by Union Carbide for highway shipments. Moreover, Union Carbide does not allow the transportation of this material by highway with other materials on the same vehicle and, based on indepth studies, it specifies the routing of all its shipments to assure minimum exposure to the public of this material during its transportation. These increased safeguards for all shipments of MIC are possible because Union Carbide is the only U.S. manufacturer and is able to control fully its distribution; however, this is not true of other materials which pose similar toxic threats in the event of a transportation emergency.
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> The DOT system for identifying and classifying the hazards of materials is the outgrowth of a system developed over the years by industry. In developing the system, industry primarily used accident experience to make judgments about the hazard posed by a material and about the adequacy of packaging methods to minimize the potential for releases of materials during transportation. Also controlling industry's assessment of the types and degree of the hazards posed by materials were its consideration only of acute threats to life, its limitation of concern to the safety of people in the immediate area of an accident, and its belief that accidents almost always would involve a fire. Since DOT's inheritance of this hazard classification system in 1967, an overall, objective assessment using current technology, has not been made to determine its continued adequacy for identifying fully the hazards posed to public safety and health when materials are released as a result of transportation accidents.
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> The tragedy of Bhopal, resulting in the deaths of more than 2,000 people, involved the release of material from a tank containing about 3,750 gallons of MIC. Fire was not involved and the DOT material classification provided no inference that such a release posed a major threat to public safety. In an attempt to understand why this release of MIC produced results similar to those normally associated with Class A Poisons and why this hazard was not identified by the DOT's system for classifying the hazards of materials, the DOT's requirements for identifying toxic hazards were reviewed. The table below which lists various materials and selected properties of materials was developed by the Safety Board. The table includes toxic materials shipped under several DOT classifications so as to compare the lethal properties of Class A Poisons with those of materials in other classifications. As can be seen from this data, the property which most distinguishes Class A Poisons from others is their higher vapor pressures (all are gases as opposed to liquids). The L_{50} values, while not directly comparable, show all listed materials to be lethal at concentrations significantly below the lower flammability limit. For example, MIC can be lethal at 5 parts per million (ppm) yet does not reach its lower flammable limit until there exists a 53,000 ppm concentration.
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> Although not specifically acknowledged by the DOT's definition, there is a relationship between the standard vapor pressure, lethality, and boiling point of materials classed as Class A Poisons. This relationship recognizes the natural tendency of toxic materials to vaporize into the air. However, it does not consider the ability of other toxic materials, when heated thermally or chemically, to vaporize as readily as Class A Poisons under standard conditions. Moreover, the definition of Class A Poisons establishes no standards or tests for determining which materials constitute a threat sufficient to be included in this classification. Furthermore, the criteria established for identifying Class B Poisons contain no upper limits on toxicity such that materials exceeding a specified toxicity would be classes as a Class A Poison and be protected during transportation at the level specified for Class A Poisons. Stated otherwise the DOT hazard classification does not consider the possible site-specific hazards to public safety and health of materials in accident environments. As can happen when materials are involved in transportation accidents, it appears that the vaporization rate of MIC at Bhopal was increased by heat generated by a chemical reaction causing the release of lethal but nonflammable vapors which were distributed widely by air currents.

[1] If a material is both flammable and meets the criteria for Poison B materials, it must be classified as flammable according to the requirements of 49 CFR 173.2.

Material	DOT class	L_{50} [1] (ppm/time)	Boiling point (°F)	Vapor pressure (mm)	Flammable limits (percent)
Methyl isocyanate	Flammable liquid	5/4 hrs	102	348	5.3-26.
Toluene diisocyanate	Poison B	10/4 hrs	484	0.024	0.9-9.5.
Phosgene	Poison A	150/10 min	47	1,180	Nonflammable.
Acrolein	Flammable liquid	150/10 min	125	214	2.8-31.
Hydrogen cyanide	Poison A	150/30 min	79	820	5.6-40.
Cyanogen chloride	Poison A	118/30 min	55	1,010	6.6-32.
Epichlorohydrin	Flammable liquid	250/4 hrs	239	13	3.8-21.
Nitric acid (red fuming)	Corrosive liquid	49/4 hrs	185	103	Noncombustible.

[1] Lethal concentration—the concentration at which 50 percent of the animals (generally rodents) die when exposed for the time specified.

The hazard indentification and classification system must identify completely the hazards posed to life and health by each material during normal transportation and during emergencies because this knowledge influences greatly decisions made about the level of protection required for containers used in transporting materials and influences public safety protection measures which are instituted when materials are released during transportation. The DOT first was cautioned in 1969 about deficiencies in its hazard classification system by the National Academy of Science (NAS) in its report, "A Study of Transportation of Hazardous Materials: A Report to the Office of Hazardous Materials of the U.S. Department of Transportation." Because the recommendations made in the NAS report were not implemented by the DOT and because similar deficiencies have been identified in accident investigations since 1972, the Safety Board has made several recommendations (R-72-44, I-76-3, R-80-12, I-81-6, and I-81-14) calling for improvements in the DOT hazard identification and classification system as well as for improvements in packaging requirements for specific hazardous materials.

One recommendation of particular importance in light of the tragedy at Bhopal is R-80-12. That recommendation called for an examination of speciality products and Class A Poisons to determine if the toxicity hazard of materials transported in DOT Specification 111 tank cars was sufficient to require the protection afforded by head shields and thermal insulation. In the Federal Railroad Administration's July 14, 1982, response to this recommendation, the Safety Board was advised that the toxicity hazards of products transported in DOT Specification 111 tank cars were being reviewed as a part of actions being taken in rulemaking Docket HM-175 and that the benefit/cost analysis for HM-175 had been completed. The FRA committed itself to including the results of the review of other products shipped in DOT Specification cars as well as the review of the benefit/cost analysis in the final action taken on Docket HM-175. Based on this commitment, the board acted on October 1, 1982, to close R-80-12 as acceptable action. On January 27, 1984, final action was taken on Docket HM-175; that action did not include an assessment of the hazards posed to public safety and health based on the toxicity of materials.

The Safety Board continues to urge that early attention be given by the DOT to re-examination of its hazard identification and classification system. However, the tragedy at Bhopal is another reminder of the need for immediate action by the DOT is identify materials that, during accident conditions, can present toxic threats to public safety and health similar to those demonstrated in the recent release of MIC. Many questions about the toxicity of materials now unanswered by DOT's hazard identification and classification system must be answered to determine which flammable liquids, Class B Poisons, corrosives, and other materials, can pose life-threatening hazards during accident conditions as we now know MIC can. For example, the properties listed in the above table indicates that acrolein poses hazards similar to those MIC. We believe these materials can be indentified expeditiously through a study of additional materials-specific properties to assess the volatility of the materials based on their vapor pressures and boiling points. In this way the hazards posed by the materials when fire does not result during accidents as well as the relationship to published toxicity data on materials can be realted [sic] to transportation environments.

The Safety Board encourages you to pursue, as a priority action, the identification of those materials now being transported that, during transportation emergencies, can pose life-threatening hazards to the public. The results of this effort then should be used to adopt, on an emergency basis, necessary changes in DOT's regulations concerning the transportation of those products found to possess hazards similar to MIC.

Respectfully yours,

Jim Burnett,

Chairman.

The Department believes there is merit in the basis concerns raised by NTSB—in particular, the points addressing inhalation risks due to the volatility of toxic liquids and the need for immediate action relative to the packaging of such materials. This NPRM addresses toxic liquids that have significant volatility, their packaging, and improved communication of their presence in transport vehicles.

Background

As mentioned by the NTSB, the present system for identifying and classifying the poisonous [toxic] hazards of materials has its basis in recommendations made to the Interstate Commerce Commission prior to transfer of regulatory responsibilities to DOT in 1967. However, the following background information on recommendations and efforts to imprve the classification system for toxic (poisonous) materials begins with the National Academy of Sciences (NAS) report in 1969 which is mentioned in the NTSB letter.

Since the NAS Report has been cited on a number of occasions, particularly that portion dealing with the classification of hazardous materials, the report of the Panel that addressed the subject is included as an appendix to this notice. There were four appendices to the NAS Report; three discussed general approaches to classification and the fourth addressed test methods for flashpoint. No new criteria were suggested for determination of inhalation risks taking into account the volatility of materials. Relevant to this NPRM is a portion of Appendix II-A addressing health hazards which reads as follows:

Appendix II-A.—Suggested Approaches to Classification

Health Hazards

The health hazards of materials being transported are characterized by their acute effects on human health according to the subcategories that follow. Note that the subject of mechanical trauma has not been considered in this classification. Consideration should be given, but is not included here, to the problem of the evolution of toxic gases during fires.

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Systemic Hazards

Degree 1. Use standard definitions for toxic substances by inhalation, ingestion, and absorption through the skin as set forth in the proposed revision of USDA Interpretation 18, Item 18, published in the Federal Register on April 4, 1969.

Degree 2. Use standard definitions for highly toxic substances (poisons) by inhalation, ingestion, and absorption through the skin given in the FHSA regulations, except that an LD_{50} or LC_{50} shall supplant the single dosage to 10 animals. This is in keeping with test methods recommended by USDA regulations, Interpretation 18, and NAS-NRC Report 1138.

Irritant Gases and Vapors, Dusts, and Mists Hazards

Degree 1. As considered here, these substances make reference to reversible local irritant effects on eyes, nose, and throat, exclusive of systemic effects. An irritant action must be determined by human experience since animal tests are not presently available. Lachrymatory action on the eye and sternutators are also included in this category.

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On June 6, 1970, the following appeared in the Federal Register

(Docket HM–51; 35 FR 8831) relative to inhalation hazards:

Advance Notice of Proposed Rulemaking

On August 21, 1968 (33 FR 11862), the Hazardous Materials Regulations Board announced a plan to revise the regulations governing the transportation of hazardous materials. That document announced the intention to issue notices of proposed rule making in at least four areas, including, "classification and labels", and invited public help in developing the basic regulatory principles to guide the Board in revising the regulations.

The Board is planning to consider, in the near future, a proposal for classification tests for poisonous materials. To assist the Board in that consideration, the public is invited to express its views on the health hazard classification tests proposed herein. This document is not a proposal to change the regulations. It is an effort to get public participation early in the rule-making process.

The present definitions of poisonous materials contain specific testing criteria only in the case of class B poisons. There are no criteria now provided for class A poisons or irritating materials (including test gases). As a result, the public cannot practically rely upon those definitions to determine when the Federal regulations apply. In order to correct that situation, the Department proposes to adopt testing criteria for those latter two categories.

The National Research Council-National Academy of Sciences assisted the Department in developing these test criteria. In addition, the testing procedures and benchmarks used by the Departments of Agriculture and Health, Education, and Welfare have also been considered to ensure harmony between the regulatory standards of the several Federal agencies having jurisdiction in this area (see, for example, § 191.1 of the regulations of the Department of Health, Education, and Welfare, 21 CFR Part 191, and § 362.116 of the regulations of the Department of Agriculture, 7 CFR Part 362).

Types of health hazards. The health hazards of materials being transported are characterized by their acute effects on human health. Hazards to be considered are:

Systemic hazards.
Contact hazards.
Irritant hazards.

Systemic hazards exist when materials are capable of causing harmful effects through inhalation, ingestion, or absorption through the skin.

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Hazard degrees. Degrees of hazard are ranked according to the potential severity of the hazard to people. The establishment of hazard degrees is necessary in order to establish packaging criteria reflecting the potential severity of the damage if a product should escape from its packaging during transportation. This potential must be taken into account in the design and integrity of packaging used in the shipment of the toxic products. The major categories and criteria are as follows:

Extremely dangerous poisons. Materials would be classified as extremely dangerous poisons if, on short exposure, they could cause deaths or major residual injury to humans. In the absence of adequate data on human toxicity, a material would be presumed to be extremely poisonous to humans if it falls within any one of the following categories when tested on laboratory animals:

* * * * *

(2) *Inhalation.* Any material that has an LC_{50} of 75 parts per million by volume or less or 0.75 milligrams per liter by volume or less of vapor, mist or dust when administered by continuous inhalation for 1 hour or less to both male and female rats, each weighing between 200 and 300 grams. If the material is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less.

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Toxic materials. Materials would be classified as toxic if on short exposure they could cause serious temporary or residual injury to humans. In the absence of adequate data on human toxicity, a material would be presumed to be toxic to humans if it falls within any one of the following categories when tested on laboratory animals:

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(2) *Inhalation.* Any material that has an LC_{50} of more than 75 parts per million by volume but not more than 200 parts per million or more than 0.75 milligram but not more than 2 milligrams per liter of vapor, mist, or dust when administered by continuous inhalation for 1 hour or less to both male and female rats, each weighing between 200 and 300 grams. If the product is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less.

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On February 12, 1971, the following appeared in the Federal Register (Docket–51; 36 FR 2934) relative to inhalation hazards:

Second Advanced Notice of Proposed Rulemaking

On June 6, 1970, the Hazardous Materials Regulations Board published an Advance Notice of Proposed Rule Making Docket No. HM–51 (35 FR 8831), inviting public assistance in developing regulatory principles for the classification of certain hazardous materials on the basis of their health hazards.

The comments received generally related to toxicity test procedures, classification, and degrees of toxicity.

Toxicity test procedures. Most commenters agreed that toxicity test procedures should be uniform among regulatory agencies, noting even minor variations by DOT could be confusing. Apprehension was displayed concerning the use of tests and other criteria which were not developed specifically for the transportation environment.

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Degrees of toxicity. There was no common opinion expressed in this area. One group of commenters suggested retaining only one toxic category as Poison B, leaving the Poison A category for gases only, and possibly placing some quantitative benchmarks on this category. Others agreed in principle with the designation of various degrees but suggested modifications.

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The present definitions of poisonous materials only contain specific testing criteria or guidelines for Class B poisons. There are no criteria or sufficiently descriptive guidelines for Class A or Class C poisons. Consequently, the public may encounter difficulty in relying solely on those definitions to determine the applicability of the regulations. In order to improve this situation, the Board proposes to adopt testing criteria wherever possible and better descriptive guidelines for all toxic materials covered by the Department's regulations.

The National Research Council-National Academy of Sciences assisted the Department in developing these test criteria. In addition, the testing procedures and hazard degrees used by the Departments of Agriculture and Health, Education, and Welfare were considered to insure harmony among the regulatory standards of Federal agencies having jurisdiction with respect to health hazards of chemicals.

The health hazards of materials being transported are proposed to be characterized by their acute effects on human health. The hazards considered are systemic hazards and irritant hazards. Systemic or internal hazards exist when materials, if inhaled, ingested, or absorbed through the skin can have harmful effects on organs and tissues other than at the site of contact.

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Degrees of hazard would be ranked according to the potential severity of the hazard to people. The establishment of hazard degrees is necessary in order to establish packaging criteria reflecting the potential severity of the damage if a product should escape from its packaging during transportation. The major categories and criteria which would be proposed are as follows:

Extremely toxic substances. Materials would be classified as extremely toxic substances if, on short exposure, they could cause death or major residual injury to humans. In the absence of adequate data on human toxicity, a material would be presumed to be extremely toxic to humans if it fell within any one of the following categories when tested on laboratory animals, according to the U.S. Department of Agriculture test procedures described under Title 7, Chapter 3, § 362.8 of the Federal Regulations.

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(2) *Inhalation:* Any material that has an LC_{50} of 50 parts per million or less by volume of a gas or vapor, or 0.50 milligrams or less of mist or dust per liter of air when administered by continuous inhalation for 1 hour to both male and female white rats (young adults). If the material is administered to the animals as a dust or mist, more than 90 percent of the particles available for

inhalation in the test must have a diameter of 10 microns or less, provided the Department finds it reasonably foreseeable that such concentrations could be encountered by man.

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Highly toxic materials. Materials would be classified as highly toxic if, on short exposure, they could cause serious temporary or residual injury to humans. In the absence of adequate data on human toxicity, a material would be presumed to be highly toxic to humans if it fell within any one of the following categories when tested on laboratory animals, according to the U.S. Department of Agriculture test procedures described under Title 7, Chapter 3, § 362.8 of the Code of Federal Regulations.

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(2) *Inhalation:* Any material that has an LC_{50} of more than 50 parts per million by volume of gas or vapor but not more than 200 sprts per million or more than 0.50 milligram, but not more than 2 milligrams of mist or dust per liter of air when administered by continuous inhalation for 1 hour or less to both male and female white rats (young adults). If the product is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less provided the Department finds that it is reasonably foreseeable that such concentrations could be encountered by man.

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On January 24, 1974, DOT published extensive proposals under HM-112 combining actions under a number of dockets, including HM-51. Included in the rulemaking was proposed adoption of a new placarding system, improved packaging for air shipments and standardized shipping paper requirements, and new definitive classification criteria for extremely and highly toxic materials. The proposals in the notice pertaining to inhalation risks were as follows:

§ 173.326 Extremely toxic materials; definition.

(a) For the purpose of this subchapter, a substance is considered to be an extremely toxic material if it falls within any one of the following categories when tested on laboratory animals according to the test procedures described in this paragraph:

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(2) *Inhalation.* Any material that has an LC_{50} or 50 parts per million or less by volume of a gas or vapor, or 0.50 milligram or less of mist or dust per liter of air when administered by continuous inhalation for 1 hour to both male and female white rats (young adults). If the material is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less, provided it is reasonably foreseeable that such concentrations could be encountered by man in transportation.

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§ 173.328a Highly toxic materials; definiton.

(a) For the purpose of this subchapter, a substance is considered to be a highly toxic material if it falls within any one of the following categories when tested on laboratory animals according to the test procedures described in this paragraph:

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(2) *Inhalation.* Any material that has an LC_{50} or more than 50 parts per million by volume of gas or vapor but not more than 200 parts per million or more than 0.50 milligram, but not more than 2 milligrams of mist or dust per liter of air when administered by continuous inhalation for 1 hour or less to both male and female white rats (young adults). If the product is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less provided it is reasonably foreseeable that such concentrations could be encountered by man in transportation.

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The comments received in response to the three notices generally reflected opposition indicating (1) no demonstrated need for change, (2) conflict with definitions of other agencies, (3) differences with international standards, (4) proliferation of sublabelling elements, and (5) increased freight rates. There were several comments relative to volatility, but not in a postive sense. A typical comment was as follows:

* * * * *

Inhalation

A liquid could have an LC_{50} of 75 ppm under laboratory test conditions but present a negligible hazard in transportation because of low vapor pressure. Similarly, a solid could be highly toxic if tested in a highly divided dust form but be shipped as particles too large to penetrate into the lungs. To be valid, this classification must embody the concept of likelihood of test concentrations actually existing in the field. This concept appears generally in statutory codes. Thus, the Federal Hazardous Substances Act says, "—provided such concentration is likely to be encountered by man when the substance is used in any reasonably foreseeable manner."

Accordingly, we recommend that the first sentence in this paragraph be revised by adding something similar to the following: "—provided such concentration is likely to be encountered by man under any reasonably foreseeable conditions in normal transportation."

The recommendation quoted above was included in the second ANPRM. No positive recommendations were received concerning a means to address the volatility of liquids in association with the LC_{50} values.

On April 15, 1976, as part of the preamble to the Final Rule under Docket HM-112 (41 FR 15976), DOT stated the following:

* * * * *

Poisonous or Toxic Materials. A number of comments were received concerning the uncertainty between extremely and highly toxic definitions as well as the confusion over the differences between irritants and ORM-A materials. It was suggested that a return to the old nonmenclature as something that was currently understood would be appropriate. It was also pointed out that the hazard class and the wording on the label and placard were different. Recently there has been considerable discussion with OSHA and the Consumer Product Safety Commission over the criteria for evaluating the poison hazard of a material. Although the proposed definition was derived after considerable discussions with the National Academy of Sciences and HEW several years ago, the current thinking is toward somewhat modified versions of these definitions. International discussions on this subject (UN and IMCO) have also indicated some need to modify the proposed definitions. It was therefore decided to return to the current definitions of Poison A and Poison B, and Irritant, and leave the definition of ORM-A essentially the same as that of ORA-A as defined by IATA. A notice will be prepared on this subject for public comment as soon as possible. New names for these hazard classes will also be considered at that time. Any material currently listed as Poison A is again listed as Poison A in the Hazardous Materials Table and any material proposed in HM-112 as Extremely Toxic has been restored to its previous classification.

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The "current thinking" alluded to was primarily related to the potential of the vapors of toxic materials to cause harm as a result of discharges during transportation, usually expressed in terms of boiling point or vapor pressure. MTB now considers its decision to terminate the proposed definitions in anticipation of development of improved methodology to be unfortunate because of the lengthy delay in bringing the matter to an appropriate resolution. If, as proposed in 1974, the rule had been adopted, materials such as MIC would have been classed Extremely Toxic Materials because of the precedence table proposed in § 173.2 (HM-112; 39 FR 3094) which would have given "Extremely toxic liquid or solid" a classification precedence over "Flammable liquid".

According to the proposed rule, under HM-112, the packaging for any extremely toxic material covered by an n.o.s. entry would have been very restricted according to § 173.328 (39 FR 3115) unless the necessary safety control measures for a material were addressed in a separate section of the regulations by rulemaking.

While MTB was awaiting further international action on resolution of the definitions pertaining to inhalation toxicity, action was taken to improve

the communication requirements for hazardous materials in transportation. On May 22, 1980, a Final Rule was issued under HM-126 (45 FR 34560) requiring, as relevant to this NPRM, that (1) dual hazards of materials addressed by n.o.s. (not otherwise specified) entries in § 172.101 (49 CFR) be recognized by new shipping names, e.g., "Flammable liquid, poisonous, n.o.s.", (2) under § 172.203(k), a shipping paper contain, in association with the shipping name specified for a material, its technical or NIOSH Registry name, for improved identification in emergencies; (3) the word "Poison" be displayed on a shipping paper in association with the description and class when the description and class do not indicate that a material is a poison; and (4) UN/NA numbers be displayed on shipping papers and packagings for direct reference to emergency response information, including DOT's Emergency Response Guidebook. While the new requirements provided substantial improvement in identifying risks, they did not provide for packagings of higher integrity for materials described as "Flammable liquid, poisonous, n.o.s." posing a substantial risk due to their volatility; therefore, the new shipping entry referenced § 173.119(m) for packaging without special regard to materials posing inhalation hazards as opposed to those posing oral and dermal hazards.

At the international level, work began as early as 1974 on the development of new criteria for toxic materials that would not only consider acute toxicity on inhalation (LC_{50}), but also the ability of material to reach a dangerous concentration in the event of a discharge.

The United Nations (UN) Committee of Experts on the Transport of Dangerous Goods had been aware for some time that a system of classification based solely on the LC_{50} of materials does not always characterize the actual hazard presented by materials in transport. What the Committee considered necessary was a method of classification and packaging grouping that more accurately reflects the probability of poisoning by considering the volatility of a material as well as its toxicity.

The first proposal to do this, submitted to the UN Committee of Experts by the delegation of the Soviet Union in December of 1974, proposed that the relative inhalation hazard of materials be assessed through determination of the material's "toxic point". The "toxic point" of a material was defined as the temperature at which the vapor concentration of a material reached its LC_{50}. Although this concept appeared sound initially, it soon became evident that the toxic point method had some practical drawbacks, relating in particular to its heavy reliance on determination of the vapor pressure of a material at a number of different temperatures in order to accurately determine its toxic point.

In response to the criticisms expersed by some members of the Committee of Experts regarding the "toxic point" method, the U.S. representative with assistance of representatives from U.S. industry began to examine alternate approaches to the problem.

In May of 1977, the United States delegation submitted an alternate proposal t the UN Committee proposing use of a material's normal boiling point as an indicator of relative volatility, rather than vapor pressure. The United Kingdom delegation proposed a third method for consideration. This method made use of LC_{50} as an indicator of acute inhalation toxicity, and used a "volatility" factor as an indicator of the potential of the substance to reach lethal concentration in event of a spill. The "volatility" of the substance was defined as the saturated vapor concentration of the substance measured at 20 °C.

The Committee of Experts carefully assessed the merits of each of the three methods and, unable to decide on the use of one method to the exclusion of the other two, and recognizing the need to address the problem of inhalation risks in transport at the earliest possible time, the Committee decided, at its Tenth Session in 1978, to adopt all three methods for publication in the next edition of the UN Recommendations. After publication of these methods and criteria in the UN Recommendations, they were implemented by the International Maritime Organization (IMO) through Amendment 17-79 to the International Maritime Dangerous Goods Code (IMDG Code). The IMDG code is the basic standard governing the international transportation of hazardous materials by sea. As shippers and carriers began to work with the new methods, it soon became evident that the use of the three methods was causing some confusion and that it would be best to settle on a single method. For this reason, the United States delegation proposed to the UN Committee that a special meeting be held to re-examine this question in an attempt to arrive at a single method. The Committee agreed, and a meeting was held in Hartford, Connecticut, in October 1981. A number of the member governments ot the UN Committee participated in the meeting, as well as the World Health Organization, the Hazardous Materials Advisory Council, and the European Council of the Federation of Chemical Manufacturers.

Following an exchange of views, the group agreed to recommend to the Committee that the following three principles be used as the framework for determining inhalation toxicity for vapours:

(a) Toxicity should be represented by LC_{50} (1 hour, rat).

(b) Inhalation potential should be represented by Saturated Vapor Concentration at a reference temperature of 20 °C.

(c) A system combining the above two factors should be developed, allowing substances to be placed in order of their overall inhalation toxicity risk.

In the months that followed, the UN Committee continued work on the development of appropriate grouping criteria on the basis of these principles. Finally, at its Twelfth Session in December 1982, The UN Committee adopted revised criteria for assessment of the inhalation hazard of materials, making use of LC_{50} and "volatility" (i.e., the saturated vapor concentration at 20 °C.).

The first international organization to implement the new method and criteria was the International Civil Aviation Organization (ICAO). This was accomplished with the publication of the first edition of the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air in 1983. These Technical Instructions, published pursuant to Annex 18 to the Convention on International Civil Aviation (Chicago Convention), are binding regulations for the international transport of hazardous materials by most governments that are participants in the Chicago Convention.

Since January 1, 1983, the HMR (§ 171.11) have contained provisions that incorporate by reference the ICAO Technical Instructions. Under these provisions, shippers of dangerous goods may offer shipments, domestically and internationally, by air as required by the ICAO Technical Instructions with certain exceptions. It is currently estimated that in excess of 80 percent of dangerous goods transported by air within the United States are now being transported in accordance with the ICAO Technical Instructions rather than in accordance with the detailed provisions of the DOT Hazardous Materials Regulations. In this context, it should be noted that under the ICAO Technical Instructions any material

which falls into Packing Group I by virtue of its toxic inhalation hazard is forbidden for transport aboard passenger and cargo-only aircraft.

The International Maritime Organization (IMO) has also implemented the new method for assessing the inhalation risk of toxic materials with the publication of Amendment 21–83 to the IMDG Code, which became effective on January 1, 1985. Since 1976 the DOT Hazardous Materials Regulations have permitted transportation of hazardous materials being imported into or exported from the United States in accordance with IMDG Code classifications. Because virtually all hazardous materials transported by sea must be transported in accordance with the IMDG Code, these materials must now be offered for transportation by sea in conformance with the improved UN inhalation assessment methods.

At approximately the same time that the UN Committee of Experts began considering the revision of criteria for classification and grouping of toxic materials presenting an inhalation risk, work was also begun on the development of a scheme for determination of the precedence of hazards of substances possessing multiple hazards. The intent of such a scheme is to establish a procedure for determining which of the hazards presented by a material would be considered the primary hazard and, therefore, establish the hazard class of the material.

In December of 1978, the Committee of Experts adopted such a scheme for determination of hazard precedence which was subsequently published in the UN Recommendations. Since that time, this scheme has been adopted both by IMO and ICAO. One of the principal concerns of the Committee during the development of this scheme was to insure that it took proper account of materials that present a serious risk of poisoning due to inhalation of vapors. Under this scheme, a liquid, other than an organic peroxide or radioactive material, is classified as a poison regardless of the level of any other risk (e.g., flammability, corrosivity, etc.), if it meets the criteria established for the Packing Group I inhalation toxicity which is the same criteria prepared for § 173.3a in this NPRM. The UN precedence scheme for classification will be fully addressed by MTB under Docket HM-181.

Taking into account the preceding background information, MTB believes the Group I criteria that is presently in effect for international transportation can and should be used as the basis for implementing improved transportation safety requirements within the United States for volatile toxic liquids. Further, MTB believes this action should be initiated immediately because action on matters to be addressed by HM-181 will not be completed in the near future.

Proposed Amendments to Part 172

§ 172.203(k)(4)—MTB proposes to add a new subparagraph that will require an additional description on a shipping paper reading "Poison-Inhalation Hazard" for any liquid hazardous material having a saturated vapor concentration at 20 °C (68 °F) equal to or greater than ten times its LC_{50} value if that value is 1000 parts per million or less. It should be stressed that this proposed requirement would apply to any liquid material (e.g., acrolein) meeting this criteria, not only materials subject to "n.o.s." packaging requirements.

§ 172.504(c)—MTB proposes to revise the sentence at the end of the paragraph to exclude materials subject to new § 172.505 from the 1000 pound placarding exception provided for motor vehicles and freight containers.

§ 172.505—A new section would be added to the placarding rules requiring POISON placards, in addition to placards required by § 172.504, to be displayed on each motor vehicle, rail car and freight container that contains any quantity of a material required to be identified by a "Poison-Inhalation Hazard" description on a shipping paper according to § 172.203(k)(4).

The MTB believes the inhalation risks presented by materials meeting the criteria proposed for § 172.203(k)(4) are significant to such a degree that communication of their nature and presence is necessary without exception.

Proposed Amendments to Part 173

§ 173.3a—MTB is proposing to add a new § 173.3a to Part 173 that will address the inhalation risks of liquid materials that are currently classed as Flammable, Corrosive, Oxidizer, Poison, or Organic Peroxide, and whose packagings are specified in sections that contain "n.o.s." (not otherwise specified) packaging requirements. This section would not apply to materials (e.g., acrolein) which have specific packaging prescribed in regulations other than general n.o.s. packagings. Matters relating to these materials will be addressed under Docket HM–181.

The proposed criteria for § 173.3a address the principal factors involved in the potential hazard presented by volatile toxic materials. These are the fundamental toxicity of material, as expressed by an LC_{50} value, and the probability that such a concentration will evolve in the atmosphere above spilled material. This latter factor is directly proportional to the vapor pressure of the liquid and is expressed as the saturated vapor concentration.

The LC_{50} is the concentration of the material in air which is most likely to cause death in 50 percent of both male and female albino rats within 14 days after a continuous exposure of one hour. For purposes of this section, the value is expressed in milliliters per cubic meter or parts per million (ppm). Provision is made for using LC_{50} data much of which is currently available in published literature instead of conducting tests involving large numbers of animals.

The saturated vapor concentration is the maximum concentration of vapor in air which is produced when the vapor is in equilibrium with the liquid at a temperature of 20 °C (68 °F). This value is also expressed in milliliters per cubic meter (ppm).

The criteria proposed are those published in the United Nations' (UN) Recommendations of the Committee of Experts on the Transport of Dangerous Goods for materials which require Group I packaging because of high inhalation toxicity. UN Recommendations specify that a material with an LC_{50} of more than 1000 ppm does not require Group I packaging due to inhalation hazards. A material is subject to Group I packaging when the LC_{50} is 1000 ppm or less and the saturated vapor concentration is ten or more times the LC_{50} value. While MTB is proposing to use the UN criteria for Group I as a basis for this proposed rule, it is not proposing to authorize use of the packagings for Group I materials specified in Chapter 9 of the UN Recommendations. The packaging proposed in this NPRM is the same as specified for Poison A materials under the current HMR with a provision for material-specific approval of other packagings based on a determination of equivalency to packagings prescribed for Poison A materials or suitable packagings specifically prescribed for certain hazardous materials in other classes (e.g., acrolein).

It is relevant to add here mention of a collateral issue. During the past two years, we have received more than 1800 letters, including more than 100 from members of Congress, protesting or questioning the use of animals in stating our toxicity criteria. Most of the letters required individual responses explaining that our present regulations do not require specific LC_{50} or LD_{50} data, but a determination as to whether a material

has a specified toxicity at a certain breakpoint. In other words, each of the present tests is a limit test requiring no more than 10 laboratory animals rather than hundreds suggested in the lettters. MTB recognizes that this NPRM proposes use of specific LC_{50} data and the problems we may face in responding to numerous protests by electing to use such data. However, we believe our public safety responsibilities outweigh the concerns expressed by opponents to use of LD_{50} or LC_{50} data and, unless an equivalent and acceptable procedure for determination of inhalation toxicity is provided as an alternative, we firmly believe LC_{50} must be used for the purposes of the new safety control measures proposed for new § 173.3a as well as the improved communication requirements proposed for shipping papers and placarding. In order to minimize testing, however, there are provisions in the proposed rule allowing conversion of 4-hour LC_{50} data to 1-hour LC_{50} data, and use of LC_{50} data contained in published tests.

Comments

Interested persons are invited to submit constructive comments on the rules proposed in this notice. MTB does not solicit comments on the technical merits of the NTSB letter (e.g., the lack of a reference temperature in the fifth column of the table in the letter). Comments are solicited on the merits of the basic issue raised by NTSB which is the purpose of this rulemaking action, i.e., improved packaging of violatile liquids that present significant toxicity risks, and improved communication of the presence of those risks during transportation.

Earlier in this preamble there is mention of comments received in response to Dockets HM-51 and 112 concerning conflicts with other agencies. Commenters are invited to point out any conflicts that could be encountered relative to the requirements of other agencies if a final rule is adopted as proposed in this NPRM. Such a consideration should take into account the fact that this NPRM is limited to proposed changes affecting shipping papers, placarding and use of packagings.

MTB requests data concerning materials that may be affected by the rules proposed in this notice. Of particular interest would be the technical names of materials affected and any additional costs that will be encountered in changing to packagings that would be required, if a final rule is adopted as proposed for § 173.3a.

Administrative Notice

A. Executive Order 12291

The effect of this rule, as proposed, does not meet criteria specified in § 1(b) of Executive Order 12291 and is, therefore, not a major rule, but is a significant rule under the regulatory procedures of the Department of Transportation (44 FR 11034). This proposed rule does not require a Regulatory Impact Analysis, or an environmental impact statement under the National Environmental Policy Act (49 U.S.C. 4321 *et sq.*) A regulatory evaluation is available for review in the Docket.

B. Impact on Small Entities

Based on limited information concerning size and nature on entities likely affected by this proposed rule, I certify this proposal will not, if promulgated, have a significant economic impact on a substantial number of small entities. This certification is subject to modification as a result of the review of comments received in response to this proposal.

List of Subjects

49 CFR Part 172

Hazardous materials transportation.

49 CFR Part 173

Hazardous materials transportation, Packaging and containers.

In consideration of the foregoing, 49 CFR Parts 172 and 173 would be amended as follows:

PART 172—HAZARDOUS MATERIALS TABLES AND HAZARDOUS MATERIALS COMMUNICATIONS REGULATIONS

1. In § 172.203, paragraph (k) would be amended by adding paragraph (k)(4) to read as follows:

§ 172.203 Additional description requirements.

* * * * *

(k) * * *

(4) If the liquid in a package has a saturated vapor concentration at 20 °C (68 °F) equal to or greater than ten times its LC_{50} (vapor) value and that value is 1000 parts per million or less, the words "Poison-Inhalation Hazard" shall be entered on the shipping paper in association with the shipping description (see § 173.3a(c) for definitions and acceptable methods for determination of LC_{50} values).

* * * * *

2. In § 172.504 the sentence following paragraph (c)(2) would be revised as follows:

§ 172.504 General Placarding requirements.

* * * * *

(c) * * *

(2) * * *

This paragraph does not apply to portable tanks, cargo tanks, tank cars, transport vehicles and freight containers subject to § 72.505 or transportation by air or water.

3. In Part 172, a new § 172.505 would be added to read as follows:

§ 172.505 Special placarding requirements for certain poisonous materials.

In addition to placards required by § 172.504, each motor vehicle, rail car and freight container that contains a material subject to the "Poison-Inhalation Hazard" shipping paper description requirement of § 172.203(k)(4) must be placarded POISON on each side and each end.

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGING

4. In Part 173, a new § 173.3a would be added as follows:

§ 173.3a Packaging; special requirements for certain poisonous materials.

(a) Notwithstanding the packaging requirements and authorizations prescribed in sections of this Chapter listed in paragraph (b)(1) of this section (including exemptions referring thereto), no person may offer for transportation a material addressed by those sections that also meets the criteria of paragraph (c) of this section except in a packaging—

(1) Specified in Subpart H of this part for any Poison A material if the packaging is made of materials that are chemically compatible with the hazardous material; or

(2) Approved by the Associate Director of HMR based on a determination that the packaging provides a level of safety equivalent to a packaging authorized in this Chapter for Poison A materials, or to packagings authorized for a hazardous material having similar hazards addressed by a specific packaging regulation of this part.

(b) This section applies to any liquid material—

(1) Addressed by the Table in § 172.101 (Column 5b) of this subchapter to a packaging requirement prescribed in §§ 173.119, 173.125, 173.134, 173.154, 173.221, 173.245, 173.249, 173.346, or 173.352, or which is addressed by an exemption, issued under Subpart B of Part 107 of this chapter, that refers to

one or more of those sections for the purpose of packaging authorization; and

(2) Having a saturated vapor concentration at 20 °C (68 °F) equal to or greater than ten times its LC_{50} (vapor) value if that value is 1000 parts per million (ppm) or less.

(c) For the purpose of this section—

(1) LC_{50} means the concentration of vapor that, when administered by continuous inhalation to both male and female young albino rats for one hour, is most likely to cause death within 14 days in one half of the animals tested. The result is expressed in millilitres per cubic meter of air (ppm).

(2) Saturated vapor concentration means the concentration of vapor at equilibrium with the liquid phase at 20 °C (68 °F) and standard atmospheric pressure expressed in millilitres per cubic meter (ppm).

(3) If LC_{50} data are available based solely on a 4-hour exposure, such data may be used by multiplying that data by two to determine an acceptable 1-hour value for the purposes of this section.

(4) LC_{50} data of a type currently published in scientific and technical handbooks, journals and texts may be used (based on the lowest published value) in place of new tests using animals to determine compliance with this section.

(49 U.S.C. 1804, 1808; 4 CFR 1.53; App. A to Part 1 and paragraph (a)(4) of App. A to Part 106)

Issued in Washington, D.C. on February 4, 1985.

Alan I. Roberts,

Associate Director for Hazardous Materials Regulation, Materials Transportation Bureau.

Appendix

The following is the report of Panel II on classification which was included in "A Study of Transportation of Hazardous Materials" prepared for DOT by the Highway Research Board and the Committee on Hazardous Materials, National Academy of Sciences-National Research Council, held in Warrenton, VA, following a meeting May 7–9, 1969.

Panel II Report

Introduction

The panel was convened to consider the basis and to develop an outline for classifying the type and degree of hazards to life or property inherent in the transportation of hazardous materials by air, rail, highway, or water in the United States. A basic criterion was that any system should be practicable and formulated in language that could be understood by persons directly involved in handling, storing, stowing, and carrying the materials.

The panel discussed how it is determined what a hazardous substance is. The panel then decided that it should construct a classification system consistent with its objective.

The objective of a classification system is to identify the type and degree of potential hazard that materials represent to life and property in transport by air, road, rail, or water so that adequate controls (packaging, identification, handling, emergency procedures, etc.) may be provided.

During the panel's deliberations, it considered the present DOT, Coast Guard, UN, and NFPA classification systems, and two that emerged from the discussions. The major problems encountered with each were also considered. From these considerations, the criteria for evaluating hazardous materials classification systems described in the following section were developed. However, it was obvious that a systematic, comparative evaluation, more comprehensive than the allotted time permitted, is needed to complete an analysis of changes that should be made in the present systems.

Pollution of the environment and aesthetic pollution were discussed. However, DOT indicated that these are covered in other than the Hazardous Materials Regulations. Therefore, the panel did not consider them further except to note that NAS Publication 1465 on Bulk Water Transportation of Hazardous Materials deals with human toxicity, aquatic toxicity, and aesthetic effects of water pollution.

The following list gives various causative factors leading to hazards in transportation that were considered in the deliberations:

1. Fire—thermal radiation, evolution of noxious gases, propagation of fire;
2. Chemical—reactions within container, reactions external to container, externally stimulated reactions, corrosion;
3. Physiological—inhalation (including suffocation), absorption, ingestion, painful irritation to eyes, tissue damage;
4. Mechanical (Physical)—overpressurizing container, puncture or impact, component defect, overfilling container.

Identification of Issues

The enabling legislation under which regulations for the transport of hazardous materials are to be promulgated does not define hazardous materials. To promote a clear understanding of the regulations and describe hazardous materials in logical classifications, such a definition must be developed. The Hazardous Substances Labeling Act (Pub. L. 86–613, 21 CFR Part 191) is suggested as a guide for development of this definition.

The panel is aware of many uses for a classification system and many were considered, but no record of the intended uses that a hazardous materials classification system must satisfy is available. This record must be developed before a recommended system can be promptly appraised.

The panel submits that the objective of the hazardous materials classification system is to identify the type and degree of potential hazard that materials represent to life and property in transport by air, road, rail, or water, so that adequate controls (packaging, identification, handling, emergency procedures, etc.) may be provided to limit that hazard. It is recognized that final tabulation of uses may require modification of this objective.

As mentioned earlier, during its deliberations the panel considered the present DOT, Coast Guard, UN, and NFPA classification systems, and two that emerged from the discussions. Also considered were the major problems with each. From these considerations, the following criteria for evaluating hazardous materials classification systems described were developed. A classification system should: (a) Contain a minimum number of categories and be intelligible to the "average man"; (b) be broad enough to cover the inherent chemical and physical characteristics of all types of materials being transported and the hazards they pose in transportation; (c) reflect multiple types of hazards; (d) be uniform for all modes of transport; (e) identify degrees (not inherent characteristics) for each type of hazard and specify thresholds for each degree; (f) consider fire, chemical, physiological, and physical hazards; (g) provide quantifiable definitions for each class; (h) consider mobility or migration of material during or after an incident; (i) consider as separate categories noxious combustion products and reactivity in fires; (j) consider mass effects; and (k) take into account (1) compatibility with classification systems for other purposes; (2) the physical state; (3) the transportation environment; (4) mixture of mixing hazards; (5) general and not specific problems; (6) storage problems; (7) emergency considerations; (8) environmental pollution problems; (9) commingling problems; (10) the possibility of inhibitors or stabilizers fractionating; and (11) materials as shipped, rather than "test tube" materials.

It was evident that a systematic, comparative evaluation, much more comprehensive than permitted in the time allotted the panel, is needed to complete an analysis of changes that should be made in the present systems. We did not have an opportunity to consider the effects of pressurization—i.e., the hazards from compressed gases, other than flammability, toxicity or reactivity.

Present regulations, developed largely empirically over the last 80 years, are not based on a rational system for classifying hazards. A classification theory is needed that provides a framework for the changes required to accommodate the demands of current and future technology.

The panel is deeply concerned about the problems presented by mixed cargoes and the compatibility of their components in the event of a package or container failure. Extensive study is needed before materials may be classified in sufficient detail to avoid combining incompatible items in cargoes. The Coast Guard is currently working on this problem and should be encouraged and expedited in the task with adequate funding.

On advice from the Office of Hazardous Materials, for purposes of this conference the classification of health hazards was restricted to those to humans without regard to effects on plants and animals. Further, the panel decided that for transportation

purposes, only acute exposures of humans need be considered.

The radioactive materials classification was not considered because it has recently been satisfactorily revised.

Because of the extensive history of the classes of explosives and current acceptance, the panel suggests the DOT continue to use the explosives categories during some interim period. However, explosives are included in the reactivity hazards category in the proposed classification system and should be incorporated into that category.

In order to establish a suitable classification system and define objectively the degree of hazard involved, it is essential that a sufficient number of quantitative tests be available to assist the classifying authority. In establishing these tests, certain principles should be considered. For new chemicals and chemicals produced in small quantities, the required tests may be limited to the basic hazards. In such cases, the remaining hazards may be covered by classification in the most hazardous grade for each type of hazard applicable until subsequent tests indicate a lesser degree of hazard.

As the quantity of a particular chemical transported increases, the tests must increase in sophistication and number to define properly the magnitude of potential hazard associated with bulk quantities. In some cases, the hazard-defining tests may become elaborate, costly, and performable only by a limited number of laboratories staffed by highly skilled personnel.

Wherever possible, the tests should be simple and easily carried out with generally available laboratory equipment. They should be so designed that the results require no subjective decisions or interpretations, may be expressed quantitatively and numerically, and are reproducible within established limits from one laboratory to another. It would be desirable that a suitable center be established for the compilation of these test results so that, whenever possible, basic test data need not be redetermined by each manufacturer.

For the development of suitable tests, several alternatives are available: (a) The establishment of a test development center, (b) the utilization of voluntary groups, such as ASTM, AIHA, and ACGIH, and/or (c) the utilization of private research firms—both profit and non-profit. Volunteer groups are currently working on the development of meaninful and quantitative test methods in several areas. To implement and expedite this program dependence must be placed on financial support from the government through contractual agreements, or industry must offer full-time participation in the voluntary efforts of working committees to assure that the tests are established by consensus rather than regulatory fiat.

Suggested Approaches

To develop an approach for recommendation to the OHM, the panel arbitrarily selected three possible new classification categories—health, flammability, and reactivity—and attempted to define the subcategories within each to make them responsive to the foregoing criteria. The panel made an effort to consider systemically the potential hazards in making this selection. The results are contained in Appendix II–A.

Conclusions and Recommendations

The panel was confronted with an inadequate data base about environmental conditions that influence the selection of credible incidents upon which the classification, at least in part, must be based. This situation precluded arriving at a conclusive recommendation for specific classification changes. However, the panel prepared a suggested classification approach to serve as a tentative system for generating comments and alternative suggestions. This suggested system is summarized in tabular form in Appendix II–B.

The lack of an adequate data base, and other aspects of the present classification problems, led the panel to suggest several programs. Specifically, the panel recommends that the following programs be undertaken to overcome present classification system deficiencies, provide a modified or new system that will meet the criteria previously identified, and provide the basis for a sound regulatory and industry/citizen hazards management program:

1. Adopt the classification system suggested in this report with its concepts as the basis for developing changes in the present classification system.

2. Make a comparative evaluation of present hazardous materials classification systems to determine their adequacy or deficiencies with respect to ideal classification system criteria, and identify specific changes required to meet these criteria.

3. Develop graphic system models for transportation modes that can be used in analyzing hazards posed by the inherent characteristics of the commodities considered as possible hazardous commodities, taking into account the environmental, handling, operational, and other pertinent elements.

4. Develop specific, quantifiable, standardized testing criteria and procedures for each hazardous material category and degree, and prepare recommended regulatory changes to accommodate each.

In addition, the following needs should be addressed in future DOT programs:

1. Definition of the term "hazardous materials" for guidance in classification efforts.

2. Declaration of the intended use of a hazardous materials classification system.

3. Development of suitable testing procedures for classifying mixtures, especially tests for flammable materials.

Timely implementation of the recommended programs can be achieved through a variety of resources available to the OHM. In addition to its own staff, services of volunteer groups, other governmental agencies, and contractors can be enlisted. For example, MCA, API, NFPA, AAR, American Trucking Association, Air Transport Association, and other interested groups such as ASTM and USASI can contribute to the program at no cost to the OHM.

Estimates of program costs depend on the extent of the programs authorized. The developed of testing procedures and practices is probably the most expensive portion of the reclassification efforts. The panel recommends that cost estimates for this work be developed with the assistance of the Bureau of Mines, Bureau of Explosives, and the NAS Advisory Center on Toxicology. Should the OHM wish the reduce the time required by volunteer groups to achieve the end results suggested, cost and time estimates can be developed through negotiations with qualified contractors.

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